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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/661,035	09/13/2000	Tomohide Terashima	49657-801	8222

7590 08/22/2002

McDermott Will & Emery
600 13th Street NW
Washington, DC 20005-3096

EXAMINER
LOKE, STEVEN HO YIN

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 08/22/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/661,035	TERASHIMA, TOMOHIDE	
	Examiner	Art Unit	
	Steven Loke	2811	

-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 June 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *7, 8, 10, 11, 13* is/are allowed.

6)☒ Claim(s) *1,3,4, 9 and 12* is/are rejected.

7)☒ Claim(s) *2,5 and 6* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☒ The proposed drawing correction filed on *6/13/02* is: a)☒ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

1. Claim 9 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The written description never discloses the fourth region is electrically connected to the second electrode portion as claimed in claim 9.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 3, 4 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitamura et al.

In regards to claim 1, Kitamura et al. discloses a semiconductor device in figs. 6(a) and 6(b), comprising: a semiconductor substrate of a first conductivity type [1]; a first region [2] of a second conductivity type formed on and in direct contact with the semiconductor substrate; a second region [8] of the second conductivity type formed at and near the surface of the first region; a third region [3] of the first conductivity type formed at and near the surface of the first region, and surrounding the second region; a first electrode portion [7] formed on the surface of the third region located between the first and second regions with an insulating film [6] therebetween; a second electrode portion [12a] connected to the second region; a third electrode portion [13] connected to the first region and spaced by a distance from the third region; and a fourth region [4] of

the first conductivity type formed at and near the surface of the first region between the third electrode portion and the third region.

Since it is well known in the semiconductor art that a depletion layer always formed adjacent to a pn junction, there would be a depletion layer formed in the n-type region [2] which is under the p-type region [4] and a depletion layer formed in portions of the n-type region [2] between portions of the p-type region [4] when the device is in an on-state. In addition, it is inherent that a current flows perpendicular to the arrangement of the p-type region [4] and portions of the n-type regions [2] when the device is in an on state. Therefore, it is inherent that in an on state a depletion layer extends from the fourth region and the depletion layer having a depth changing as a position moves in a direction crossing a direction flow of the current.

In regards to claim 3, it is inherent that the fourth region [4] is fixed to a constant potential because the source electrode [12a] is always connected to a constant source potential.

In regards to claim 4, Kitamura et al. further discloses the fourth region [4] is electrically connected to the second electrode portion [12a].

In regards to claim 12, Kitamura et al. differs from the claimed invention by not showing the fourth region is a continuous region having changing depths in a direction crossing a direction of current flow.

It would have been obvious for the fourth region is formed by the impurity diffusion method because it is a widely used method to form a semiconductor region in a

semiconductor device. Therefore, the pn junction formed between the p-type region [4] and the n-type region [2] would be a curved junction.

Since the fourth region can be an impurity diffusion region, the fourth region would have a depth changing as a position moves in a direction crossing a direction of flow of the current.

4. Applicant's arguments filed 6/13/02 have been fully considered but they are not persuasive.

It is urged, in page 6 of the remarks, that claim 9 is supported by Figures 26, 27, and 29, and the accompanying portions of the specification. However, neither the drawings nor the written specification discloses the fourth region [7] is electrically connected to the second electrode portion (emitter region [6]) as claimed in claim 9.

It is urged, in pages 8-10 of the remarks, that Kitamura does not teach a depletion layer extending from the fourth region having a depth changing as position moves in a direction crossing a direction of the flow of the current as required in claim 1. However, it is well known in the semiconductor art that a depletion layer always adjacent to the pn junction. See "Semiconductor devices - Physics and Technology" by Sze, 1985, pages 70-83. Therefore, there would be a depletion layer formed in the n-type region [2] which is under the p-type region [4] and a depletion layer formed in portions of the n-type region [2] between the portions of the p-type region [4] when the device is in an on state. Since a current would flow perpendicular to the arrangement of the p-type region [4] and portions of the n-type regions [2] in Kitamura when the device is in on-state, Kitamura et al. does show a depletion layer extending from the fourth region having a

depth changing as position moves in a direction crossing a direction of the flow of the current as required in claim 1.

5. Claims 7, 8, 10, 11 and 13 are allowed.

6. The following is a statement of reasons for the indication of allowable subject matter: The major difference in the claim not found in the prior art of record is a fourth region of the first conductivity type formed at and near the surface of the first region between the third electrode portion and the third region; and the fourth region having a depth changing as a position moves in a direction crossing a direction of flow of current.

7. Claims 2, 5 and 6 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP§706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven Loke whose telephone number is (703) 308-4920. The examiner can normally be reached on 7:50 am to 5:20 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

sl
August 15, 2002

Steven Loke
Primary Examiner